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UNITED STATES PATENT APPLICATION

For: SCREENING OF A PRINTED-CIRCUIT ELECTRONICS  
CARD MOUNTED ON A METAL SUBSTRATE

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England, hereby declare that I am conversant with the  
French and English languages and am a competent  
translator thereof. I declare further that to the best  
of my knowledge and belief the following is a true and  
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Signed this 27<sup>th</sup> day of September 1999



J. F. BRADLEY

For and on behalf of Engineering Translations

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## "SCREENING OF A PRINTED-CIRCUIT ELECTRONICS CARD

MOUNTED ON A METAL SUBSTRATE

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9 <sup>INS B1</sup> Background of the Invention

The present invention relates to the electromag-  
5 netic screening of a printed-circuit electronics card  
mounted on a metal substrate.

It finds a non-limiting application advanta-  
geously to the protection of control circuits of dis-  
charge lamps.

10 <sup>INS B2</sup> Such electromagnetic screening is generally  
achieved by means of a metal cover closed over the sub-  
strate.

At present, two main types of techniques are  
used to fit such a cover.

15 <sup>INS B3</sup> According to a first type of solution, the elec-  
trical connection of the metal cover to the earth which  
the metal substrate constitutes is formed independently  
of the mechanical fixing of the said cover with respect  
to the said substrate and to the electronics card. For  
20 example, the electrical connection to earth may then be  
formed by means such as riveting, screwing, a soldered  
joint or even a soldered wire link.

In a second type of solution, the metal cover is  
fixed mechanically to the substrate by means of an ad-  
25 hesive which is made from an electrically conducting  
material and which carries out the electrical connec-  
tion function.

However, these two types of solutions both ex-  
hibit drawbacks.

30 In particular, the solutions in which the me-  
chanical fixing and electrical connection are achieved  
by different means require additional operations during  
manufacture and are expensive.

Moreover, with these solutions, the leaktight-  
35 ness between the metal cover and the substrate is not  
generally assured.

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Equally, the solutions in which a conducting adhesive are used also carry a high cost particularly because of the operation of applying a bead of adhesive.

Moreover, with these solutions, the adhesive joints pose problems of behaviour over time, as well as

*INS B4* of response to temperature and to vibration.  
*9 Brief Summary of the Invention*

One object of the invention is to propose a screening solution which does not exhibit these drawbacks.

*10 INS B5* To this end, the invention proposes an assembly including a printed-circuit electronics card mounted on a metal substrate, as well as a metal screening cover electrically connected to the substrate, the substrate exhibiting a recessed gutter in which the edge of the  
*15* cover is accommodated, the said edge being crimped onto the said substrate in the gutter.

*INS B6* The invention also proposes a method for producing such an assembly, characterised by the following stages:

- 20* - the substrate is stamped so as to form a gutter in it,
- the electronics card is assembled onto the said substrate,
- the cover is positioned on the assembly thus obtained, arranging the edge of the said cover in the  
*25* said gutter,
- the said edge is crimped onto the said substrate.

*4 Brief Description of the Drawing*

Other characteristics of the invention will  
*30* emerge further from the description which follows. This description is purely illustrative and not limiting.

*INS B7* It should be read in the light of the attached drawings on which:

- Figure 1 is a diagrammatic representation in a  
*35* sectional view illustrating the fixing of a screening

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cover in accordance with one possible embodiment for the invention;

- Figures 2a and 2b are diagrammatic representation, in a top view, illustrating two possible crimping  
5 modes;

- Figures 3 and 4 are diagrammatic representations in a sectional view similar to that of Figure 1 illustrating a possible implementation for crimping the

*Fig B 87*  
metal cover onto the substrate.  
*Detailed Description of Invention*

10 In Figure 1, a metal substrate 1, a printed-circuit electronics card 2 and a metal screening cover 3 have been represented.

*Fig B 97*  
The substrate 1 has a recessed gutter 4 produced by stamping the material. This gutter 4 extends over  
15 the said substrate along a contour which corresponds to that of the edge of the metal cover 3.

This gutter 4 is intended to accommodate the edge of the metal cover 3.

The metal cover 3 is fixed into the gutter 4 by  
20 crimping.

*Fig B 107*  
To this end, the said edge is extended by one or more tabs 5, which form an L-shaped return extending  
outwards from the cover 3.

*Fig B 117*  
Such a tab 5 is accommodated in a region of the  
25 gutter 4 which is shaped with a width which coincides with that of the said tab 5. Hence, the said tab 5 is inserted exactly into the recessed shape of the gutter 4.

The length of such a tab 5 is 3 mm, for example,  
30 while that of a recessed pattern which accommodates it is 4 mm.

The cover 3 is mounted onto the substrate 1 in the following way.

The substrate 1 is first of all stamped so as to  
35 form the gutter 4. At the same time an excess of mate-

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rial is obtained which in this instance constitutes the edge of the gutter 4.

Next, the electronics card 2 is assembled onto the substrate 1.

5 The cover 3 is then put in place in the gutter 4.

10 *Ans B12* When the cover 3 is correctly positioned, localised crimping is carried out, by lateral displacement of the material of the substrate on top of corners of the tabs 5 of the cover 3. The material displaced during the crimping is that which forms the edges of the gutter originating from the stamping. More particularly, as Figures 2a and 2b illustrate, the material pushed back by the stamping during the formation of the gutter exerts on the tabs 5, after crimping, parallel forces cancelling each other out. The material displaced during the crimping is referenced by 6.

20 Two implementations are possible: the crimping can be carried out by crushing a fairly short part of the substrate coming to cover over the fairly long tabs 5 (Figure 2a); in a variant, it can be carried out by simultaneous crushing of two parts of the substrate coming to cover over fairly short tabs 5 (Figure 2b).

25 *Ans B13* As Figures 3 and 4 illustrate, the mould in which the substrate 1 is stamped may be shaped in such a way that the said stamped substrate 1 exhibits, at the edge of the gutter 4, a protuberance 7 which constitutes the excess material to be displaced during the crimping; the height of this protuberance is adjusted so as to remain below the upper level of the electronics card 2, so as not to prevent the screen-printing of the soldering paste for mounting the components prior to the cover 3 being put in place.

35 *Ans B14* Moreover, the depth of the gutter 4 is adjusted so that the bottom of the said gutter 4 and the return 5 are below the electronics card 2. This makes it pos-

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sible to prevent/ any risk of leakage of electromagnetic waves.

Advantageously, during the initial crimping, only some of the tabs of the cover 5 are used, which makes it possible to preserve the possibility of using the other tabs, in the event of a subsequent dismantling, for a second crimping.

Consequently, the method which has just been described is compatible with a removal of the cover.

10 The technique which has just been described exhibits numerous advantages:

- it is much simpler than the prior techniques, since the mechanical mounting of the cover, the positioning thereof and the forming of electrical contact  
15 between the cover and the metal substrate are carried out in a single operation;

- the completed assembly allows for an absence of leakages of electromagnetic waves;

- the metal substrate remains perfectly leak-  
20 tight, since it is free from perforations;

- the mechanical rigidity of the assembly as a whole is enhanced; in particular, the gutter formed over the whole of the periphery of the metal substrate constitutes a rib which contributes to this rigidity;  
25 this rigidity is also enhanced by the stamping of the cover when it is crimped onto the metal substrate; it will be noted that the increase in the rigidity obtained makes it possible to reduce the thickness of the metal substrate;

30 - equally, with the technique proposed, it is possible to remove then to refit the cover.

The screening which has just been described may be used in all fields of electronics where insulated metal substrates are used, and particularly advantageously in motor vehicle electronics, energy conver-  
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sion, power supplies, power multiplexers, electric motor power supplies, etc.

5 In particular it can be employed in the screening of the control circuit (ballast, according to the terminology of the person skilled in the art) of a discharge lamp where the problem of leakages of electromagnetic waves has not been completely resolved up to the present.

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